**WE CLAIM:**

1. An apparatus for transmitting data to a distribution substation, wherein the distribution substation is configured to receive encoded data in a power signal on a distribution line in a power distribution network, the apparatus comprising:

a transformer that includes a primary winding that is coupled to the distribution line and a secondary winding that is coupled between a first node and a second node;

a half-bridge drive circuit that is configured to selectively assert a first drive signal and second drive signal in response to a control signal;

a first driver that is coupled between a first power-supply node and a common node, wherein the first driver is arranged to couple the first power-supply node to the common node when the first drive signal is asserted;

a second driver that is coupled between the common node and the second power-supply node, wherein the second driver is arranged to couple the common node to the second power-supply node when the second drive signal is asserted; and

a resonant circuit that is coupled between the first node and the common node, wherein the resonant circuit has a natural resonant frequency in an audio frequency range, and wherein the half-bridge driver is arranged to selectively activate the first and second drivers such that the power-line is modulated with a square-wave signal at a frequency that is associated with the encoded data.

2. The apparatus of claim 1, wherein the resonant circuit comprises a series combination of a resistor, a capacitor, and an inductor.

3. The apparatus of claim 1, wherein the square-wave signal has a frequency that is approximately in arrange from 970Hz to 1006Hz.

4. The apparatus of claim 1, wherein the square-wave signal has a frequency that is selectively changed between two frequencies via the control signal such that the encoded data corresponds to a frequency shift keyed (FSK) modulated signal.

5. The apparatus of claim 1, further comprising a transmitter carrier generator block, wherein the transmitter carrier generator block is arranged to: increase a phase signal when an interrupt occurs, capture a temporary phase error signal from the phase signal when a zero-crossing is detected in the power signal, compare the temporary phase error signal to a last phase error signal, increase a phase error signal when the last phase error signal is greater than the temporary phase error signal, filter the phase error signal to provide a filtered phase error signal, calculate a correction signal from the filtered phase error signal using a proportional gain block and a differential gain block, and adjust a time interval associated with the interrupt in response to the correction signal.

6. The apparatus of claim 1, further comprising:

an upstream carrier generation block that is arranged to provide a trigger clock signal in response to the power signal such that the trigger clock signal is locked to a frequency that corresponds to approximately 128 times another frequency that is associated with the power signal; and

a numerical oscillator that is responsive to the trigger clock, wherein the numerical oscillator is arranged to toggle between a digital bit at a rate that is associated with a transmitter frequency.

7. The apparatus of claim 6, the numerical oscillator comprising:

an accumulator block that is arranged to store a value; and

a summer block that is arranged to increase the value stored in the accumulator by a constant when triggered by the trigger clock, wherein at least one output of the accumulator block is employed to generate the digital bit such that the transmitter frequency is changed by changing the constant.

8. The apparatus of claim 6, further comprising an endpoint processor unit is arranged to selectively adjust the constant in the numerical oscillator to encode data in the power signal.

9. An apparatus for supplying power to an endpoint from a power signal on a distribution line in a power distribution network, the apparatus comprising:

a transformer that includes a primary winding that is coupled to the distribution line and a secondary winding that is coupled between a first node and a second node;

a first diode circuit that is coupled between a first power-supply node and the common node;

a second diode circuit that is coupled between the common node and a second power-supply node;

a third diode circuit that is coupled between the second node and the second power-supply node;

a fourth diode circuit that is coupled between the first power-supply node and the second node; and

a capacitor circuit that is coupled between the first supply node and the second supply node.

10. The apparatus of claim 9, further comprising a resonant circuit, wherein the secondary winding of the transformer is coupled to the common node through the resonant circuit.

11. The apparatus of claim 9, further comprising: a zener diode circuit that is coupled between the first power-supply node and the second power-supply node.

12. The apparatus of claim 9, wherein the apparatus is further arranged such that a top plate of the capacitor circuit is coupled to the first node through the first diode and

resonant circuit when the power signal has a first polarity, a bottom plate of the capacitor circuit is coupled to the second node through the third diode circuit when the power signal has the first polarity, the top plate of the capacitor is coupled to the second node through the fourth diode circuit when the power signal has a second polarity, and the bottom plate of the capacitor is coupled to the first node through the second diode and resonant circuit when the power signal has the second polarity, whereby a local power supply is generated by the capacitor circuit across the first power supply node and the second power supply node.

13. The apparatus of Claim 9, further comprising:

a half-bridge drive circuit that is configured to selectively assert a first drive signal and second drive signal in response to a control signal;

a first driver that is coupled between the first power-supply node and the common node, wherein the first driver is arranged to couple the first power-supply node to the common node when the first drive signal is asserted;

a second driver that is coupled between the common node and the second power-supply node, wherein the second driver is arranged to couple the common node to the second power-supply node when the second drive signal is asserted; and

a resonant circuit, wherein the secondary winding of the transformer is coupled to the common node through the resonant circuit, wherein the resonant circuit has a natural resonant frequency in an audio frequency range, and wherein the half-bridge driver is arranged to selectively activate the first and second drivers such that the power-line is modulated with a square-wave signal at a frequency that is associated with an encoded data signal.

14. An apparatus for generating a transmitter clock frequency from a power signal, comprising:

a phase accumulator block that is arranged to increase a phase signal in response to an interrupt;

a phase latch block that is arranged to capture a temporary phase error signal from the phase signal when a zero-crossing is detected in the power signal;

a comparator block that is arranged to compare the last error signal to the temporary phase error signal;

a first summer block that is arranged to increase an error signal when the last error signal is greater than the temporary phase error signal, and further arranged to decrease the error signal when the last error signal is less than the temporary phase error signal;

a first delay block that is arranged to provide the last error signal in response to the error signal;

a filter block that is arranged to provide a filtered signal in response to the phase error signal;

a second delay block that is arranged to provide a last filtered signal in response to the filtered signal;

a second summer block that is arranged to subtract the last filtered signal from the filtered signal to provide a difference signal;

a first gain block that is arranged to provide a proportional signal in response to the filtered signal, wherein the proportional signal is related to the filtered signal according to a proportional gain factor;

a second gain block that is arranged to provide a differential signal in response to the difference signal, where the differential signal is related to the difference signal according to a differential gain factor;

a third summer block that is arranged to combine the proportional signal and the differential signal to provide a correction signal; and

a third gain block that is arranged to provide a proportional and differential correction signal that is related to the correction signal by a proportional and differential gain factor, and

a fourth summer block that is arranged to increase a timer adjustment signal in response to the correction signal such that a time interval associated with the interrupt is adjusted by changing the timer adjustment signal.

15. An endpoint that is arranged to communicate with a distribution substation with a power signal over a distribution line in a power distribution network, the endpoint comprising:

a means for locking that is arranged to lock a transmitter frequency to a multiple of the frequency that is associated with the power-signal;

a means for generating that is arranged to generate a carrier frequency for the transmitter in response to the transmitter frequency and a data signal such that the carrier frequency is changed according to the data signal; and

a means for modulating that is arranged to modulate the power-signal according to the carrier frequency.

16. The endpoint of claim 15, further comprising a means for formatting that is arranged to format a packet for transmission according to a packet protocol, wherein the packet protocol includes a asynchronous flag field, a health flag field, a payload field, and an error check and detection field, wherein the payload field is defined by a predetermined sequence when the asynchronous flag field is not set, and wherein the payload field is flexibly defined when the asynchronous flag field is set.

17. The endpoint of claim 15, further comprising: a means for powering that is arranged to generate a local power supply for the endpoint using the power signal.